

U.S. Patent Application No. 10/689,771
Amendment dated September 24, 2007
Reply to Office Action of August 1, 2007

REMARKS/ARGUMENTS

Reconsideration and continued examination of the above-identified application are respectfully requested.

Upon entry of this amendment, claims 1-63 remain pending in this application. No claim has been canceled, withdrawn, or added. Claims 43, 62 and 63 have been amended.

Amendments are made to claim 43 to further clarify that *at least one of said plurality of grooves comprises a groove opening having a groove opening diameter and a groove interior having a groove interior diameter wherein the groove interior diameter is greater than the groove opening diameter*, and further that the at least one groove is substantially filled by at least one projection such that said members are at least mechanically *interlocked together by the at least one projection and the at least one groove engaged by overlapping*, such as supported in the descriptions in paragraphs [0011] at page 4 and [0024] at page 8, and Figs. 1-3, and elsewhere in the present application. Claims 62 and 63 have been amended to omit several of the original listed species recited in each claim. No new matter is introduced.

Allowable Subject Matter

The applicants acknowledge with appreciation the determination and indication of the allowability of claims 1-42 at pages 8-9 of the most recent Office Action.

The applicants also understand that claims 43-63 are the subject of a new grounds of rejection in the most recent Office Action. In view of the foregoing amendments made to claim 43 and the following remarks, the applicant kindly request reconsideration of those currently rejected claims.

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Rejection of Claims 43-45, 51-57, 59, 62 and 63 under 35 U.S.C. §103(a) -- Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506)

At pages 3-6 of the Office Action, the Examiner rejects claims 43-45, 51-57, 59, 62 and 63 under 35 U.S.C. §103(a) as being unpatentable over Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506). With respect to independent claim 43, the Examiner indicates that Shintaku et al. teaches a sputter target assembly where the target assembly has a member (i.e., backing plate) having a bonding side with a plurality of projections, and a member (i.e., target) having a bonding side with a plurality of grooves. The plurality of grooves is filled with the plurality of projections. The target and the backing plate are bonded by solder (Abstract; Figs. 1-3). The Examiner also references various teachings of Shintaku et al. with respect to dependent claim 44 (Abstract; Figs. 1-3), claims 52 - 55 (Abstract), and claims 62 -63 (Fig. 1-3). The Examiner indicates that the differences between Shintaku et al. and the present claims are that the member having the grooves being metal having a melting point higher than that of the metal which comprises the projections is not discussed (claim 43), the plurality of grooves being substantially filled by the at least one projection such that the members are at least mechanically bonded together is not discussed (claim 43), the member having the grooves is the backing plate and the member having the projections is the target are not discussed (claim 45), the members being bonded or joined by an interlocking bond and/or mechanical joint are not discussed (claim 51), the member having the grooves being cobalt, titanium, copper, aluminum, tantalum, niobium, nickel, zirconium, hafnium, silver, gold or alloys thereof is not discussed (claim 56), the member having the grooves comprises tantalum or alloys thereof is not discussed (claim 57) and the member having the projections being cobalt, titanium, copper, aluminum, tantalum, niobium, nickel, zirconium,

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hafnium, silver, gold or alloys thereof is not discussed (claim 59). Regarding the member having the grooves being a metal having a melting point higher than that of the metal, which comprises the projections (claim 43), the Examiner indicates that Hunt et al. teaches that the target can be titanium and the backing plate is aluminum (column 8, line 29). The Examiner also indicates that Hunt et al. teaches the target can have holes drilled in it for binding to the backing plate (column 6, lines 13-34). Regarding the plurality of grooves being substantially filled by the at least one projection such that members are at least mechanically bonded together (claim 43), the Examiner references Hunt et al. as teaching grooves being substantially filled by the at least one projection such that members are at least mechanically bonded together (column 6, lines 27-34). Regarding the member having the grooves being the backing plate and the member having the projections being the target (claim 45), the Examiner indicates that Hunt et al. suggests that either surface can have the grooves and the projections. Regarding the members being bonded or joined by an interlocking bond and/or mechanical joint (claim 51), the Examiner indicates that Hunt et al. teaches the grooves being substantially filled by the at least one projection such that the members are at least mechanically bonded together (column 6, lines 27-34). Regarding the member having the grooves being cobalt, titanium, copper, aluminum, tantalum, niobium, nickel, zirconium, hafnium, silver, gold or alloys thereof (claim 56), the Examiner indicates that Hunt et al. teaches that the target can be titanium and the backing plate can be aluminum (column 8, line 29). According to the Office Action, Hunt et al. teaches the target can have holes drilled in it for bonding to the backing plate (column 6, lines 13-34). Regarding the member having the grooves comprising tantalum or alloys thereof (claim 57), the Examiner indicates that Hunt et al. teaches that the target can be titanium and the backing plate can be aluminum (column 8, line 29). According to the Office Action, Hunt et al. teaches that the target can have holes drilled in it for bonding to the backing plate (column 6, lines 13-34), and

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further suggests the target can be tantalum (column 8, lines 19-23). Regarding the member having the projections being cobalt, titanium, copper, aluminum, tantalum, niobium, nickel, zirconium, hafnium, silver, gold or alloys thereof (claim 59), the Examiner indicates that Hunt et al. teaches that the target can be titanium and the backing plate can be aluminum (column 8, line 29) and that Shintaku et al. teaches that the backing plate can have projections (abstract). According to the Office Action, the motivation for using the features of Hunt et al. is that it allows for producing a target that is resistant to shear failure (column 4, lines 39-42). The Examiner indicates that it therefore would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Shintaku et al. by using the features of Hunt et al. because it allows for producing a target that is resistant to shear failure. Reconsideration and withdrawal of this rejection is respectfully requested in view of the following reasons.

Claim 43, as amended, recites a sputtering target assembly comprising a member having a bonding side with a plurality of projections, and a member having a bonding side with a plurality of grooves. The member having the grooves is a metal having a melting point higher than that of the metal which comprises the projections. Further, *at least one of the plurality of grooves comprises a groove opening having a groove opening diameter and a groove interior having a groove interior diameter wherein the groove interior diameter is greater than the groove opening diameter.* The at least one groove is substantially filled by at least one projection such that the members are at least mechanically *interlocked together by the at least one projection and said at least one groove engaged by overlapping.* A solder alloy, solder metal, braze alloy, or braze metal also is disposed between the member having the grooves and the member having the projections. As explained in the present specification, this sputtering target assembly, such as recited in present claim 43, avoids debonding problems by providing a fail-safe bond between

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the target and the backing plate (e.g., paragraph [0005] at page 3). Further, the presence of the braze or solder metal or alloy can strengthen or permit the bond between the contact surfaces, and can require less energy to form the desired bond than friction welding *per se* (e.g., paragraph [0034] at pages 13-14). Consistent with the recitations of amended claim 43, dependent claims 62 and 63, as amended, further recite that the projections are substantially cones, truncated cones, pyramids, obelisks, or wedges, or combinations thereof, and the grooves are substantially in the shape of a "T", "L", semicircle, truncated triangle, cusp, or a bowtie, respectively.

With respect to the rejection of claim 43, the Office Action enclosed a partial English-translation of Shintaku et al., which was limited to the Abstract thereof. The remainder of the Shintaku et al. reference was provided with the Office Action in the original Japanese language version of the publication, inclusive of the figures. The Abstract of Shintaku et al. included with the English-translation thereof indicates that the back of target material 11 is bonded to the backing plate 12 by solder. It is also indicated that the backing plate 12 has protrusions 10 that are embedded in the target material 11. The protrusions apparently are used to control temperature increase of the target material 11, and absorbs the heat concentrated on the intermediate region 9 more sufficiently than the heat at the central and peripheral parts. This is done to reduce temperature distribution of the target material 11, and thereby to prevent crazing and cracking of the target material 11 due to prevention of thermal stress. As apparent from Fig. 1(a) and Figs. 2(a), 2(b), and 2(c) of Shintaku et al., the protrusions 10 on backing plate 12 are not shown or taught to have a configuration that mechanically interlocks with any groove in target material 11 whereby the protrusion 10 of plate 12 and an opening in target material 11 are engaged by overlapping. Instead, protrusions 10 in Fig. 1(a) of Shintaku et al. are rectangular in cross section as explained in the Abstract and shown in the figure; protrusions 10 in Fig. 2(a) thereof are shown to be triangular-shaped with a diameter that

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progressively becomes smaller away from the flat upper surface or land area of plate 12; protrusions 10 in Fig. 2(b) thereof are shown to be trapezoidal-shaped with a diameter that progressively becomes smaller away from the flat upper surface or land area of plate 12; and protrusions 10 in Fig. 2(c) thereof are shown to be rectangular-shaped with rounded distal ends.

Therefore, in addition to failing to disclose that target material 11 having grooves is a metal having a melting point higher than that of the metal of backing plate 12 which comprises the projections, as acknowledged in the Office Action, Shintaku et al. also fails to teach or suggest *at least one of the plurality of grooves comprises a groove opening having a groove opening diameter and a groove interior having a groove interior diameter*, nor does this reference teach or suggest the at least one groove is substantially filled by at least one projection such that the members are at least mechanically *interlocked together by the at least one projection and said at least one groove engaged by overlapping*. As can be appreciated, present claim 43 differs from Shintaku et al. in numerous significant respects. By failing to provide for a mechanical interlock between the protrusions of backing plate 12 and indentations in target member 11, Shintaku et al. does not provide a bond between plate 12 and member 11 that will prevent and avoid debonding problems in the nature achieved by the sputtering target assembly of the present invention.

Also, although the Office Action suggests that Shintaku et al. teaches projections such as pyramids relevant to present claim 63, pyramids are not taught by Shintaku et al. that are inverted such that distal ends of the projections overlap with and are mechanically interlocked with corresponding grooves in the other member having a groove interior diameter that is greater than the groove opening diameter.

The secondary reference to Hunt et al. does not make up for the above-noted significant

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differences between Shintaku et al. and the present claims. Hunt et al. relates to a sputter target/backing plate assembly and method of making same that, like Shintaku et al., fails to provide for projections from the back (16') that overlap with and are mechanically interlocked with corresponding holes 28 drilled into sputter target (10') wherein holes 28 would have a hole interior diameter that is greater than the hole opening diameter. Instead, Hunt et al. requires that the mouth of the hole 28 on sputter target 10' have a peripheral burr so that it can mechanically interlock with the metal of the other component 16' and the hole 28 becomes smaller at its distal end than at the mouth (e.g., see col. 6, lines 27-34; col. 8, lines 5-16; Figs. 8-9). As such, the geometries of the "grooves" and "projections" of Hunt et al. to be provided to combine sputter target 10' and backing plate 16' are completely opposite to those recited in the present claim 43. Hunt et al. leads one of ordinary skill away from the present invention in at least this respect.

Therefore, the proposed combination of Shintaku et al. and Hunt et al. in the rejection fails to meet all of the present limitations of claim 43, and, accordingly, it does not render claim 43 *prima facie* obvious. Dependent claims 44-45, 51-57, 59, 62 and 63 are not obvious over Shintaku et al. and Hunt et al. for at least the same reasons as set forth above in regard to their parent claim 43.

In view of the above, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claims 46-48, 60 and 61 under 35 U.S.C. §103(a) – Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506) and Ivanov et al. (WO 00/15863)

At pages 6-7 of the Office Action, the Examiner rejects claims 46-48, 60, and 61 under 35 U.S.C. §103(a) as being unpatentable over Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506), as applied to claims 43-45, 51-57, 59, 62 and 63, and further in view of Ivanov et al. (WO 00/15863). The Examiner indicates that the differences not yet discussed is the

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gap existing between a portion of the bonding sites (claim 46), the width of the gap (claim 47), the portion of bonding sides in contact (claim 48), the member having projections comprising a copper-chromium or copper-zinc alloys (claim 60) and the projections being of irregular shape. Regarding claim 36, the Examiner indicates that the bond is formed such that a gap is formed between at least a portion of the bonding side of the target member and a portion of the bonding side of the backing member (Figs. 4-6); and the peripheral edge where there is a material interposed between a portion of the bonding side of the backing member, and the results in a gap between the two members. Regarding claim 47, according to the Office Action, the gap is less than 0.1 inch (page 9, lines 4-6), and as to claim 48, a portion of the bonding sides are in contact (Figs. 4-6), and as to claim 60, the member having the projections can comprise copper-chromium (page 7, lines 13-17; page 9, lines 10-11), and as to claim 61, the projections can be irregular shape (Fig. 3). According to the Office Action, the motivation for using the features of Ivanov et al. is that it allows for bonding a sputtering target to a backing plate (abstract). The Examiner indicates that therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the features of Ivanov et al. because it allows for bonding a sputtering target to a backing plate. Reconsideration and withdrawal of this rejection is respectfully requested in view of the following reasons.

The comments above regarding the cited references apply equally here. As explained previously in the record, Ivanov '863 is directed to the use of "cold pressing" and a "low temperature pressure consolidation" approach for joining the target and backing members (e.g., see page 3, line 25 to page 4, line 2; page 6, lines 3-5, 13-16). According to Ivanov '863, prior diffusion bonding techniques led to undesirable growth in the grain size of low melting point targets, and the Ivanov '863 reference indicates that a low temperature target bonding approach is needed to avoid

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inducing such grain growth (see page 3, lines 9-13). Ivanov '863 therefore indicates that heating of the target members should be avoided, such as would be expected to be associated with providing a solder alloy, solder metal, braze alloy, or braze metal as disposed between the member having the grooves and the member having the projections, as recited in present claim 43. Therefore, Ivanov '863 teaches away from the present invention. Further, at page 7, lines 13-15 of Ivanov '863, it states:

A plurality of salient portions of projections 8b are formed on the harder of either one of the surfaces 11b [bottom side of target 2b] or 13b [top side of backing plate 4b].

Words in brackets ([]) added. Ivanov '863, at page 7, lines 13-15, therefore teaches that the projections are formed on the *harder* of the target and plate surfaces, which is opposite to the presently claimed invention. Ivanov '863 has a similar instruction provided at page 8, lines 15-20. Also, Ivanov '863 does not teach use of a solder material on at least one groove.

In view of the above, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claims 49 and 50 under 35 U.S.C. §103(a) -- Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506) and Wegmann et al. (U.S. Pat. No. 4,983,269)

At pages 7-8 of the Office Action, the Examiner rejects claims 49 and 50 under 35 U.S.C. §103(a) as being unpatentable over Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506), as applied to claims 43-45, 51-57, 59, 62 and 63, and further in view of Wegmann (U.S. Pat. No. 4,983,269). The Examiner indicates that the difference not yet discussed is the use of a cell (claims 49, 50). Regarding claims 49 and 50, the Examiner indicates that Wegmann teaches forming a cell member having a plurality of sides where the cell member is proximate to the interface of the target and the backing plate (Fig. 8). One of the sides can constitute

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a portion of the bonding site of the backing plate (Fig. 8), and a gas can be disposed inside the cell, which can be the same as the sputtering process atmosphere (column 4, lines 1-22), and the gas can be at any pressure including atmospheric (column 4, lines 4-10). According to the Office Action, the motivation for providing a cell is that it allows for detecting erosion (column 3, lines 23-27). The Examiner indicates that therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the features of Wegmann because it allows for detecting erosion of the targets. Reconsideration and withdrawal of this rejection is respectfully requested in view of the following reasons.

The comments above regarding the cited references apply equally here. Whatever relevance Wegmann might arguably have with respect to the recitations of claims 49 and 50 alone, it does not make up for the above-identified differences between presently pending parent claim 43 and the cited references of Shintaku et al. and/Hunt et al.

In view of the above, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claim 58 under 35 U.S.C. §103(a) -- Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506) and Ohhashi et al. (U.S. Pat. No. 5,693,203)

At page 8 of the Office Action, the Examiner rejects claim 58 under 35 U.S.C. §103(a) as being unpatentable over Shintaku et al. (Japan 01-052065) in view of Hunt et al. (U.S. Pat. No. 5,836,506), as applied to claims 43-45, 51-57, 59, 62 and 63, and further in view of Ohhashi et al. (U.S. Pat. No. 5,693,203). The Examiner indicates that the difference not yet discussed is the use of niobium (claim 58). Regarding claim 58, the Examiner asserts that Ohhashi et al. teaches a target made of niobium (column 6, line 4). The Examiner indicates that the motivation for using a target of niobium is that it allows for depositing films of niobium (column 6, line 4). The Examiner indicates

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that therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a niobium target as taught by Ohhashi et al. because it allows for depositing films of niobium. Reconsideration and withdrawal of this rejection is respectfully requested in view of the following reasons.

The comments above regarding the cited references apply equally here. Whatever relevance Ohhashi et al. might arguably have with respect to the recitations of claim 58 alone, it does not make up for the above-identified differences between presently pending parent claim 43 and the cited references of Shintaku et al. and/Hunt et al.

In view of the above, reconsideration and withdrawal of the rejection are respectfully requested.

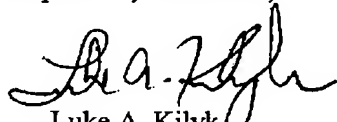
The Examiner is encouraged to contact the undersigned should there be any remaining questions as to the patentability of the claimed invention in view of the cited references.

CONCLUSION

In view of the foregoing remarks, the applicants respectfully request the reconsideration of this application and the timely allowance of the pending claims.

If there are any fees due in connection with the filing of this response, please charge the fees to Deposit Account No. 03-0060. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such extension is requested and should also be charged to said Deposit Account.

Respectfully submitted,


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